(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 748 872 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.12.2020 Bulletin 2020/50

(51) Int Cl.:
H04B 10/116 *(2013.01)* ***H04M 1/02*** *(2006.01)*

(21) Application number: **20170331.1**

(22) Date of filing: **20.04.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **05.06.2019 CN 201910487543**

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(54) ELECTRONIC DEVICE

(57) The present disclosure relates to an electronic device (1). The electronic device (1) can include a device body (11), a screen (12), and a photo-sensing module (13). The light-transmissive area (14) can be provided between the screen (12) and a side casing (111) of the device body (11). A light emitter (131) of the photo-sensing module (13) is mounted at an edge portion of the device body (11) and corresponds to the light-transmissive area (14). The light emitter (131) can emit a light through the light-transmissive area (14) towards a sensing space (139) corresponding to a front side of the device body (11) for sensing.

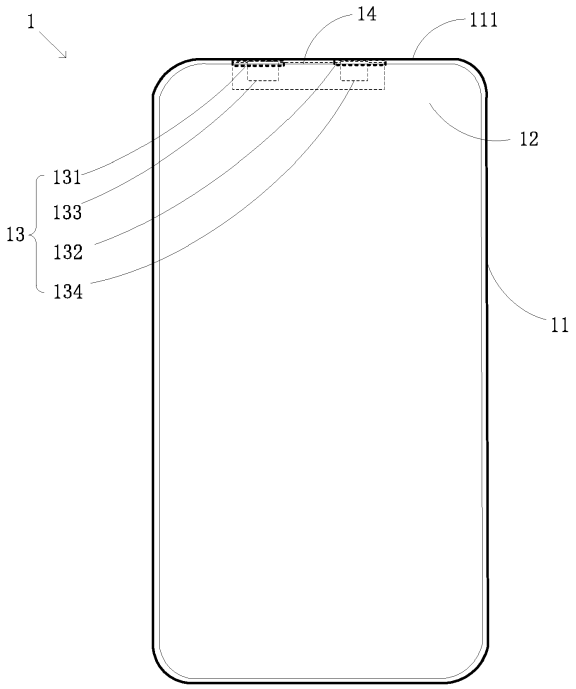

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present disclosure generally relates to the field of electronic technologies, and more particularly, to an electronic device.

BACKGROUND

[0002] In electronic devices, such as mobile phones, it is desirable to minimize the size of a non-display area of a front surface of the electronic device relative to a screen area. This can be accomplished by arranging a light-transmissive hole cooperating with a photosensor in the non-display area or locating a light-transmissive area matching the size of the photosensor on the screen of the electronic device, in order to increase a screen-to-body ratio of the electronic device. However, a display effect of the screen and an aesthetic appearance of the whole device can still be affected by the non-display area with reduced size, and the display effect of the screen is reduced by the light-transmissive area on the screen.

SUMMARY

[0003] Embodiments of the present disclosure provide an electronic device that can include a device body, a screen, and a photo-sensing module. The electronic device can futher include a light-transmissive area being provided between the screen and a side casing of the device body. The photo-sensing module can include a light emitter, a light receiver, an emitting circuit, and a receiving circuit, where the emitting circuit is electrically coupled with the light emitter, the receiving circuit is electrically coupled with the light receiver, the light emitter is mounted at an edge portion of the device body and corresponding to the light-transmissive area. An emitted light from the light emitter transmits out through the light-transmissive area and enters a sensing space corresponding to a front side of the device body.

[0004] In some embodiments, the light receiver is mounted at the edge portion of the device body.

[0005] In some embodiments, the light-transmissive area is arranged between the side casing at a top portion of the device body and the screen, and the light emitter and the light receiver are mounted at the edge portion of the top portion of the device body; or the light-transmissive area is arranged between the side casing at a bottom portion of the device body and the screen, and the light emitter and the light receiver are mounted at the edge portion of the bottom portion of the device body.

[0006] In some embodiments, the light-transmissive area includes a first area located between a first side wall of the side casing of the device body and the screen, and a second area located between a second side wall of the side casing of the device body and the screen, the first side wall is adjacent to the second side wall, and one of the light receiver and the light emitter is arranged in the first area, while the other one is arranged in the second area.

[0007] In some embodiments, the first side wall is the side casing at the top portion of the device body, and the second side wall is the side casing at a left side of the device body and adjacent to the side casing at the top portion of the device body; the first area is located at a left portion of the top edge of the device body, the second area is located at an upper portion of the left side edge of the device body.

[0008] In some embodiments, the light receiver is mounted below the screen.

[0009] In some embodiments, the emitting circuit and the receiving circuit are integrated on a first control chip, and the first control chip is mounted at an edge portion of the device body.

[0010] In some embodiments, the emitting circuit is arranged on a second control chip, the receiving circuit is arranged on a third control chip, and the second control chip and the third control chip are mounted at the edge portion of the device body, so that the second control chip is located adjacent to the light emitter, while the third control chip is located adjacent to the light receiver.

[0011] In some embodiments, the photo-sensing module further includes a barrier wall, and the barrier wall is arranged between the light emitter and the light receiver.

[0012] In some embodiments, the light-transmissive area includes a hole structure of a presetshape or a structure of a light-transmissive material.

[0013] In some embodiments, the light-transmissive area further includes a gap between the side casing of the device body and the screen.

[0014] In some embodiments, the screen is a full screen covering the front side of the device body, the side casing of the device body corresponds to a side portion of the device body.

[0015] In some embodiments, the screen is a curve screen, and an edge of the curve screen is bent towards a side of the device body, the side casing of the device body is a casing fitted with the edge of the curve screen and corresponding to a side portion of the device body.

[0016] In some embodiments, the electronic device is of a structure with an upper layer and a lower layer, the upper layer and the lower layer are slidable relative to each other, and the screen is arranged on the upper layer of the electronic device, the side casing of the device body is a side casing of an upper device body.

[0017] In some embodiments, the light-transmissive area is an elongated stripe, a circle, or an oval.

[0018] The technical scheme provided by the embodiments of the present disclosure can have following beneficial effects.

[0019] With the light-transmissive area between the side casing of the device body and the screen, and the light emitter of the photo-sensing module at the edge portion of the device body and corresponding to the portion of the light-transmissive area, the light emitter can

emit a light through the light-transmissive area towards the sensing space corresponding to the front side of the device body for sensing. In an aspect regarding a structure, the light emitter does not cause interference on a mounting space for the screen. In an aspect regarding a function, the light emitted from the light emitter does not cause interference on display effect of the screen. In addition, since the light-transmissive area is arranged between the side casing and the screen, improvement in structures of the screen and the casing of the device body of the electronic device can be reduced, and difficulties in processing and the cost are lowered.

[0020] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments consistent with the disclosure and, together with the description, serve to explain the principles of the disclosure.

FIG. 1 is a schematic diagram of an electronic device according to an exemplary embodiment of the present disclosure.

FIG. 2 is a schematic diagram of a light path of a photo-sensing module according to an exemplary embodiment of the present disclosure.

FIG. 3 is a schematic diagram of an electronic device according to another exemplary embodiment of the present disclosure.

FIG. 4 is a schematic diagram of an electronic device according to still another exemplary embodiment of the present disclosure.

FIG. 5 is a schematic diagram of a photo-sensing module according to an exemplary embodiment of the present disclosure.

FIG. 6 is a schematic diagram of an electronic device according to yet another exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION

[0022] Exemplary embodiments of the present disclosure will be described in detail and examples of the embodiments will be illustrated in the drawings. When the following description refers to the drawings, unless specified otherwise, the same numbers in different drawings represent the same or similar elements. The implementations described in the following exemplary embodiments do not represent all implementations consistent with the present disclosure, and instead they are merely examples of devices and methods consistent with aspects of the present disclosure as detailed in the appended claims.

[0023] In the related art, a size of a non-display area of a front surface of an electronic device is usually reduced, and a light-transmissive hole cooperating with a photosensor is defined in the non-display area or a light-transmissive area matching a size of the photosensor is arranged on a screen, in order to increase a screen-to-body ratio of the electronic device, such as a mobile phone. However, a display effect of the screen and an aesthetic appearance of the whole device are still affected due to the existing non-display area even if the size is reduced. The display effect of the screen is reduced with the light-transmissive area, since light is emitted perpendicularly to the light-transmissive area on the screen.

[0024] FIG. 1 is a schematic diagram of an electronic device according to an exemplary embodiment of the present disclosure. As illustrated in FIG. 1, the electronic device 1 includes a device body 11, a screen 12 and a photo-sensing module 13. A light-transmissive area 14 can also be provided between the screen 12 and a side casing 111 of the device body 11. The photo-sensing module 13 includes a light emitter 131, a light receiver 132, an emitting circuit 133, and a receiving circuit 134. The light emitter 131 is mounted at an edge portion of the device body 11 and corresponds to the light-transmissive area 14.

[0025] The light emitter 131 emits a light, the light can pass out through the light-transmissive area 14 and enters a sensing space 139 corresponding to a front side of the device body, so as to detect an obstacle approaching the front side of the device body. The emitting circuit 133 is electrically coupled with the light emitter 131 to control operation of the light emitter 131. The receiving circuit 134 is electrically coupled with the light receiver 132 to control operation of the light receiver 132. Referring to FIGS. 2 and 5, the sensing space 139 refers to an overlapping space of an emitting inverted cone formed by the light emitter 131 and a receiving inverted cone formed by the light receiver 132.

[0026] The screen 12 can cover a portion of the front side of the device body, or cover the whole front side of the device body 11 to exhibit a full-screen display effect. Alternatively, the screen 12 can be a special screen, such as a foldable screen, a curved screen, and the like, which is not limited herein.

[0027] Corresponding to the type of the screen, the side casing 111 of the device body 11 is a casing of the device body 11 which is fitted with the screen 12 and mounted together with the screen 12. For example, when the screen 12 is a full screen covering the front side of the device body, the side casing 111 of the device body 11 corresponds to a side portion of the device body 11. Accordingly, the light-transmissive area 14 directly faces the front side of the device body, such that light emitted from the light emitter 131 directly faces the sensing space 139corresponding to the front side of the device body. When the screen 12 is a curved screen, and an edge of the curved screen is bent towards a side of the device body 11, the side casing 111 of the device body 11 is a

casing which is fitted with the edge of the curve screen and corresponds to the side portion of the device body 11. In other words, the side casing 111 is aligned with the edge of the curved screen. The light emitter 131 and the light receiver 132 of the photo-sensing module 13 can cooperate with a structural member capable of changing a light path, such as a lens, so that a light is emitted towards the sensing space 139 corresponding to the front side of the device body.

[0028] In addition, when the electronic device 1 is of a structure with an upper layer and a lower layer which are slidable relative to each other, and the screen 12 is arranged on the upper layer of the electronic device, the side casing 111 of the device body 11 is a side casing of an upper device body.

[0029] With the light-transmissive area 14 between the side casing 111 of the device body 11 and the screen 12, and the light emitter 131 of the photo-sensing module 13 at the edge portion of the device body 11 and corresponding to the portion of the light-transmissive area 14, the light emitter 131 can emit a light through the light-transmissive area 14 for sensing. In an aspect regarding a structure, the light emitter 131 does not cause interference on a mounting space for the screen 12. In an aspect regarding a function, the light emitted from the light emitter 131 does not cause interference on display effect of the screen 12. In addition, since the light-transmissive area 14 is arranged between the side casing 111 of the device body and the screen 12, improvement in structures of the screen 12 and the side casing 111 of the device body of the electronic device 1 can be achieved, and difficulties in processing and the cost can be lowered.

[0030] It should be noted that, the light-transmissive area 14 can be a hole structure of a preset shape or a structure of a light-transmissive material. The present shape of the light-transmissive area 14 can be an elongated stripe, a circle, an oval, and the like, which is not limited herein. When the light-transmissive area 14 is a hole structure, it can be directly a gap defined between the side casing 111 of the device body and the screen 12 during mounting, which not only increases an amount of the emitted light and improves the sensing effect of the photo-sensing module 13, but simplifies the structures of the screen 12 and the side casing 111 of the device body of the electronic device 1, reducing difficulties in processing and the cost.

[0031] When the light-transmissive area 14 is a structure of a light-transmissive material, the light-transmissive material can satisfy requirements of a light-transmissive effect and improve consistency in appearance of the electronic device 1. For example, when the emitted light is an infrared light of 850nm/940nm, the light-transmissive area 14 is made from a light-transmissive material which only allows the infrared light of 850nm/940nm to pass through, the infrared light of 850nm/940nm can pass through the light-transmissive material, and it is can be ensured that the appearance of the present light-transmissive area is consist with those of other structures of the electronic device 1.

[0032] In the above embodiments, the electronic device 1 can be a mobile phone, a tablet computer, an in-vehicle device, a medical terminal, and the like, which is not limited in the present disclosure. In the following, the mobile phone is taken as an example of the electronic device 1, a mounting portion of the light receiver 132 and the fitting between the light receiver 132 and the device body 11 are exemplarily illustrated.

[0033] The light emitter 131 of the photo-sensing module 13 can emit an emitted light of a corresponding type. As shown in FIG. 2, a light path of the emitted light and a light path of the receiving light overlap at an overlap area depicted by dotted lines. Upon the emitted light encounters the obstacle in the overlap area, the receiving light reaches the light receiver 132 and is received by the light receiver 132.

[0034] In an embodiment, as shown in FIG. 1, both the light emitter 131 and the light receiver 132 are mounted at the edge portion of the device body 11 of the mobile phone and correspond to the light-transmissive area 14. Both the emitted light from the light emitter 131 and the receiving light travelling towards the light receiver 132 are transmitted through the light-transmissive area 14, not only a transmitting effect of the emitted light and the receiving light are enhanced, but also interference on a display effect of the screen 12 caused by the light for sensing is avoided.

[0035] The light-transmissive area 14 can be arranged between the side casing 111 at a top portion of the device body and the screen 12, and the light emitter 131 and the light receiver 132 are mounted at the edge portion of the top portion of the device body 11, such that approach of a user's face can be sensed and fed back when the user uses the mobile phone.

[0036] Specifically, when the user gets talks on the mobile phone, his face approaches the front side of the device body 11, he aligns his ear with a receiver on the top portion of the mobile phone and aligns his mouth with a microphone on a bottom portion of the mobile phone. The area and probability that the light is shielded at the edge portion of the top portion of the mobile phone are large based on the above usage habits, the convenience and light sensitivity of the photo-sensing module 13 can be improved with the light-transmissive area 14 arranged between a top side of the side casing 111 of the device body and the screen 12, and the light emitter 131 and the light receiver 132 mounted at the edge portion of the top portion of the device body 11. All indications of directions, such as left, right, above, below, etc. are defined in a viewing direction of the user. The viewing direction of the user is the direction in which the user looks at his electronic device during the regular use of the device, in particular if the device is in the portrait mode (and not in the landscape mode).

[0037] Alternatively, the light-transmissive area 14 can be arranged between the side casing 111 at a bottom portion of the device body and the screen 12, and the

light emitter 131 and the light receiver 132 are mounted at the edge portion of the bottom portion of the device body 11, such that approaches of different body portions of the user can be sensed according to different habits when the user uses the electronic device 1.

[0038] Alternatively, as shown in FIG. 3, the light-transmissive area 14 includes a first area 141 between a first side wall 1111 of the side casing 111 of the device body and the screen 12, and a second area 142 between a second side wall 1112 of the side casing 111 of the device body and the screen 12. As shown, the first side wall 1111 can be adjacent to the second side wall 1112. One of the light receiver 132 and the light emitter 131 corresponds to the first area 141 in portion, and the other one corresponds to the second area 142 in portion. The light emitter 131 and the light receiver 132 are arranged at the edge portions of two adjacent sides of the device body 11, so as to improve flexibility of arrangement of a photo-sensing assembly and optimize arrangement of the space in the electronic device 1 for mounting.

[0039] Furthermore, the first side wall 1111 or the second side wall 1112 is the side casing 111 at the top portion of the device body. For instance, the first side wall 1111 is the side casing 111 at the top portion of the device body, and the second side wall 1112 is the side casing 111 at a left side of the device body and adjacent to the side casing 111 at the top portion of the device body. The first area 141 is located at a slightly left portion of the top edge of the device body 11, the second area 142 is located at a slightly upper portion of the left side edge of the device body 11. The light emitter 131 corresponds to the second area 142 in portion, the light receiver 132 corresponds to the first area 141 in portion, and the light path of the emitted light and the light path of the receiving light overlap at the overlap area.

[0040] Upon the emitted light encountering the user's face in the overlap area, the receiving light reaches the light receiver 132 and is received by the light receiver 132 to achieve the sensing effect. With the light-transmissive area 14 at the edge portions of the top portion and the left side of the mobile phone, and the light emitter and the light receiver 132 corresponding to the two areas of the light-transmissive area 14, the trend of the light path and the sensing effect of the photo-sensing module 13, as well as space arrangement of structures in the electronic device 1 are optimized.

[0041] In another embodiment, as shown in FIG. 4, the light emitter 131 is mounted at an edge portion of the device body 11 and corresponds to the light-transmissive area 14, and the light receiver 132 is mounted below the screen 12. The emitted light from the light emitter 131 is transmitted through the light-transmissive area 14, and the receiving light travelling towards the light receiver 132 is transmitted through the screen 12. On the one hand, influence on display effect of the screen 12 caused by the emitted light can be avoided, and on the other hand, space occupied by the photo-sensing module 13 in the top space of the mobile phone can be reduced, which provides more space for mounting function assemblies at the top portion of the mobile phone, such as an antenna, a camera module, and the like.

[0042] In addition, as shown in FIG. 5, the photo-sensing module 13 further includes a barrier wall 135, the barrier wall 135 is arranged between the light emitter 131 and the light receiver 132. Since the emitted light is emitted from the light emitter 131, and a reflected light can be formed after the emitted light reaches an inner side wall of the device body 11 and the screen 12, the barrier wall 135 between the light emitter 131 and the light receiver 132 can avoid a ground noise caused by the reflected light reaching the photo-sensing module 13.

[0043] The photo-sensing module 13 can implement sensing based on energy or travel time of the light, which is not limited herein. For example, the light emitter 131 can be a vertical cavity surface emitting laser (VCSEL) or an infrared light emitting diode (LED). The light receiver 132 can be a photo diode (PD) or a single photon avalanche diode (SPAD which is a photoelectric detection avalanche diode with single photon detection capacity). When the light emitter 131 is a VCSEL, the emitted light is laser light. When the light emitter 131 is the infrared light emitting diode, the emitted light is infrared light. Particularly, the infrared light can be infrared light of 850nm/940nm. During operation of the light emitter, a part of the emitted light reflects off a side wall of the device body 11 or other structure of the electronic device 1, in such case, the light reflected back to the photo-sensing module 13 becomes ground noise which affects the sensing effect. Because the VCSEL has a small emitting angle and concentrated emitting energy with less reflected light, the photo-sensing module 13 receives less ground noise, while the infrared light emitting diode has large emitting angle with many reflected light paths, the forming probability of ground noise is large.

[0044] Regarding the mounting position of two types of the light receiver 132, when the receiving light is received, the photo-sensing module 13 can monitor intensity or return time of the receiving light by means of the emitting circuit 133 and the receiving circuit 134, to calculate a distance between the obstacle and the electronic device 1. When the distance is smaller than a value, the electronic device 1 is controlled to shut down the screen to avoid touching the screen 12 by mistake and reduce power consumption.

[0045] As shown in an embodiment of FIG. 5, the emitting circuit 133 and the receiving circuit 134 can be integrated on a first control chip 136, and the first control chip 136 is mounted at an edge portion of the device body 11. The emitting circuit 133 and the receiving circuit 134 can be integrated on the same control chip so as to reduce an overall size of the photo-sensing module 13, and the mounting portion at the edge portion of the device body 11 reduces the space in the electronic device 1 occupied by the photo-sensing module 13. Further, the emitting circuit 133 and the receiving circuit 134 integrated on the first control chip 136 can also improve convenience in

controlling the photo-sensing module 13.

[0046] In an embodiment shown in FIG. 6, the emitting circuit 133 can be arranged on a second control chip 137, the receiving circuit 134 is arranged on a third control chip 138, and the second control chip 137 and the third control chip 138 are mounted at the edge portion of the device body 11. The second control chip 137 corresponds to the light emitter 131 in portion, and the third control chip 138 corresponds to the light receiver 132 in portion. Separately arrangement of the emitting circuit 133 and the receiving circuit 134 makes it convenient for mounting and cooperation between the second control chip 137 and the light emitter 131, and between the third control chip 138 and the light receiver 132, thereby improving flexibility in mounting structures and convenience of test and maintenance of circuits.

[0047] With the light-transmissive area 14 between the side casing 111 of the device body 11 and the screen 12, and the light emitter 131 of the photo-sensing module 13 at the edge portion of the device body 11 and corresponding to the portion of the light-transmissive area 14, the light emitter 131 can emit a light through the light-transmissive area 14 for sensing. In an aspect regarding a structure, the light emitter 131 does not cause interference on a mounting space for the screen 12. In an aspect regarding a function, the light emitted from the light emitter 131 does not cause interference on display effect of the screen 12. In addition, since the light-transmissive area 14 is arranged between the side casing 111 of the device body and the screen 12, improvement in structures of the screen 12 and the side casing 111 of the device body of the electronic device 1 can be reduced, and difficulties in processing and the cost can be lowered.

[0048] Other embodiments of the disclosure will be apparent to those skilled in the art from consideration of the specification and practice of the technical solutions disclosed here. This application is intended to cover any variations, uses, or adaptations of the disclosure following the general principles thereof and including such departures from the present disclosure as come within known or customary practice in the art.

Claims

1. An electronic device (1), comprising:

a device body (11) having a side casing (111);
a screen (12) that is mounted to the device body (11);
a light-transmissive area (14) that is arranged between the screen (12) and the side casing (111) of the device body (11); and
a photo-sensing module (13) that includes a light emitter (131), a light receiver (132),
an emitting circuit (133), and a receiving circuit (134), where:
the emitting circuit (133) is electrically coupled with the light emitter (131),
the receiving circuit (134) is electrically coupled with the light receiver (132),
the light emitter (131) is mounted at an edge portion of the device body (11) that corresponds to the light-transmissive area (14), and
wherein light emitted from the light emitter (131) passes out through the light-transmissive area (14) into a sensing space (139) that corresponds to a front side of the device body (11).

2. The electronic device (1) according to claim 1, wherein the light receiver (132) is mounted at the edge portion of the device body (11).

3. The electronic device (1) according to claim 2, wherein:

the light-transmissive area (14) is arranged between the side casing (111) at a top portion of the device body (11) and the screen (12), and the light emitter (131) and the light receiver (132) are mounted at the edge portion of the top portion of the device body (11); or
the light-transmissive area (14) is arranged between the side casing (111) at a bottom portion of the device body (11) and the screen (12), and the light emitter (131) and the light receiver (132) are mounted at the edge portion of the bottom portion of the device body (11).

4. The electronic device (1) according to claim 2, wherein the light-transmissive area (14) comprises:

a first area (141) located between a first side wall (1111) of the side casing (111) of the device body (11) and the screen (12), and
a second area (142) located between a second side wall (1112) of the side casing (111) of the device body (11) and the screen (12),
wherein the first side wall (1111) is adjacent to the second side wall (1112), and one of the light receiver (132) and the light emitter (131) is arranged in the first area (141), while the other one is arranged in the second area (142).

5. The electronic device (1) according to claim 4, wherein the first side wall (1111) is the side casing (111) at the top portion of the device body (11), and the second side wall (1112) is the side casing (111) at a left side of the device body (11) and adjacent to the side casing (111) at the top portion of the device body (11); the first area (141) is located at a left portion of the top edge of the device body (11), the second area (142) is located at an upper portion of the

left side edge of the device body (11).

6. The electronic device (1) according to claim 1, wherein the light receiver (132) is mounted below the screen (12).

7. The electronic device (1) according to any one of claims 1 to 6, wherein the emitting circuit (133) and the receiving circuit (134) are integrated on a first control chip (136), and the first control chip (136) is mounted at the edge portion of the device body (11).

8. The electronic device (1) according to any one of claims 1 to 6, wherein:

the emitting circuit (133) is arranged on a second control chip (137),
the receiving circuit (134) is arranged on a third control chip (138), and
the second control chip (137) and the third control chip (138) are mounted at the edge portion of the device body (11), so that the second control chip (137) is located adjacent to the light emitter (131), while the third control chip (138) is adjacent to the light receiver (132).

9. The electronic device (1) according to any one of claims 1 to 8, wherein the photo-sensing module (13) further includes a barrier wall (135), and the barrier wall (135) is arranged between the light emitter (131) and the light receiver (132).

10. The electronic device (1) according to any one of claims 1 to 9, wherein the light-transmissive area (14) includes a hole structure of a preset shape or a structure of a light-transmissive material.

11. The electronic device (1) according to claim 10, wherein the light-transmissive area (14) further comprises a gap between the screen (12) and the side casing (111) of the device body (11).

12. The electronic device (1) according to any one of claims 1 to 11, wherein the screen (12) is a full screen covering the front side of the device body (11), the side casing (111) of the device body (11) corresponds to a side portion of the device body (11).

13. The electronic device (1) according to any one of claims 1 to 11, wherein the screen (12) is a curve screen, and an edge of the curve screen is bent towards a side of the device body (11), the side casing (111) of the device body (11) is a casing fitted with the edge of the curve screen and corresponding to a side portion of the device body (11).

14. The electronic device (1) according to any one of claims 1 to 11, wherein the electronic device (1) is of a structure with an upper layer and a lower layer, the upper layer and the lower layer are slidable relative to each other, and the screen (12) is arranged on the upper layer of the electronic device (1), the side casing (111) of the device body (11) is a side casing (111) of an upper device body (11).

15. The electronic device (1) according to any one of claims 1 to 14, wherein the light-transmissive area (14) is an elongated stripe, a circle, or an oval.

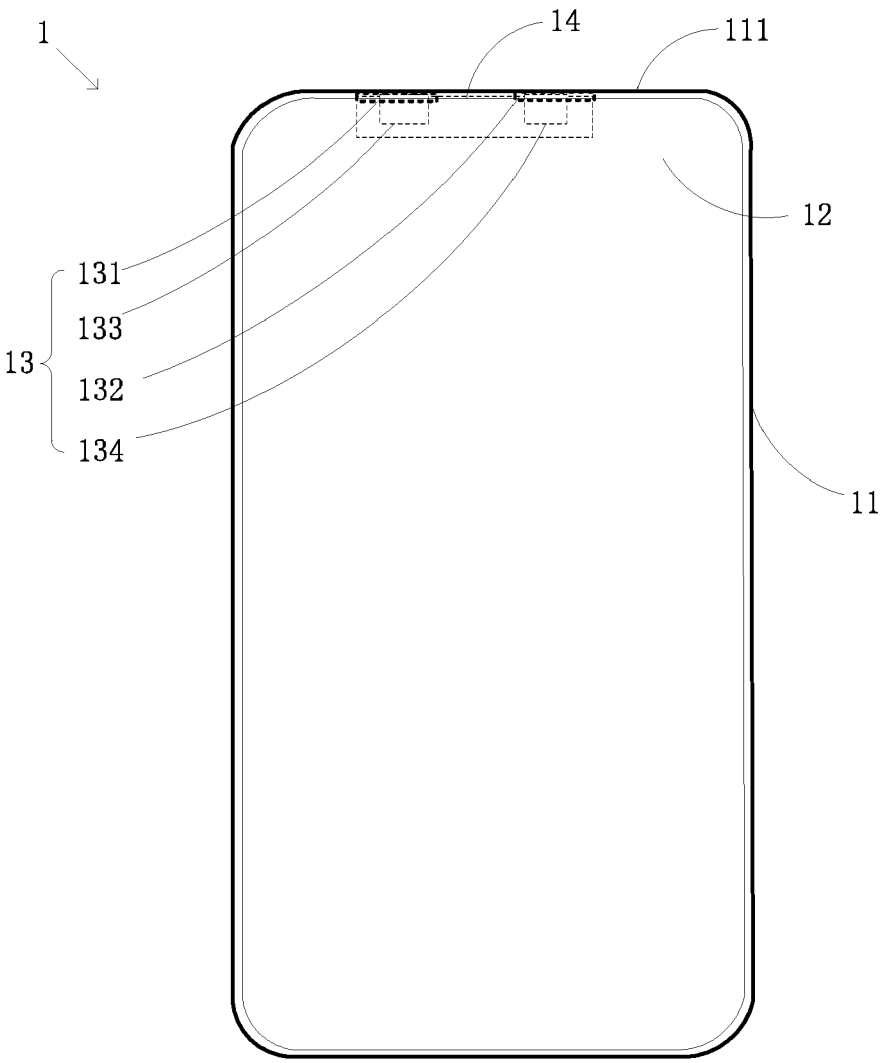

FIG. 1

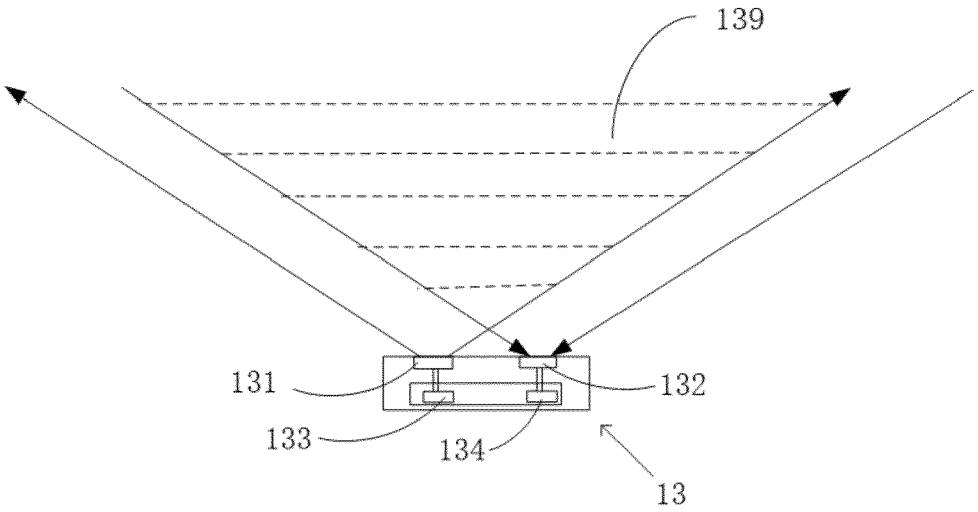

FIG. 2

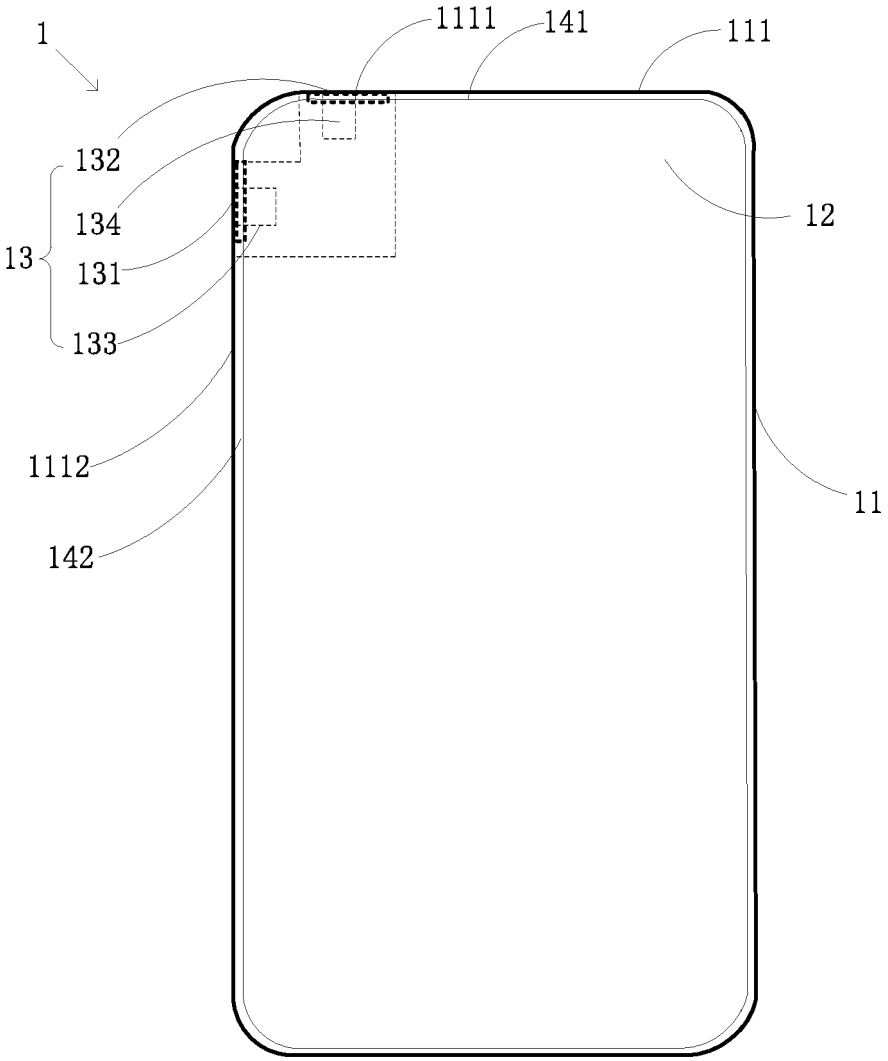

FIG. 3

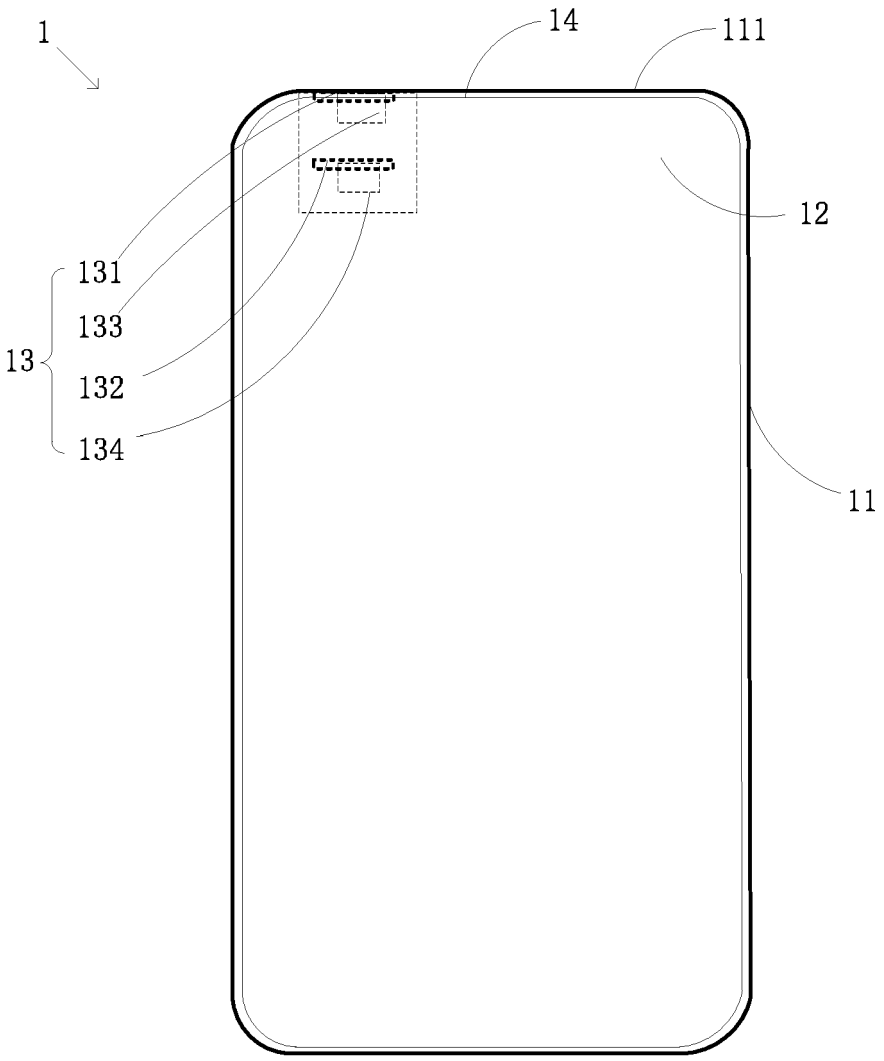

FIG. 4

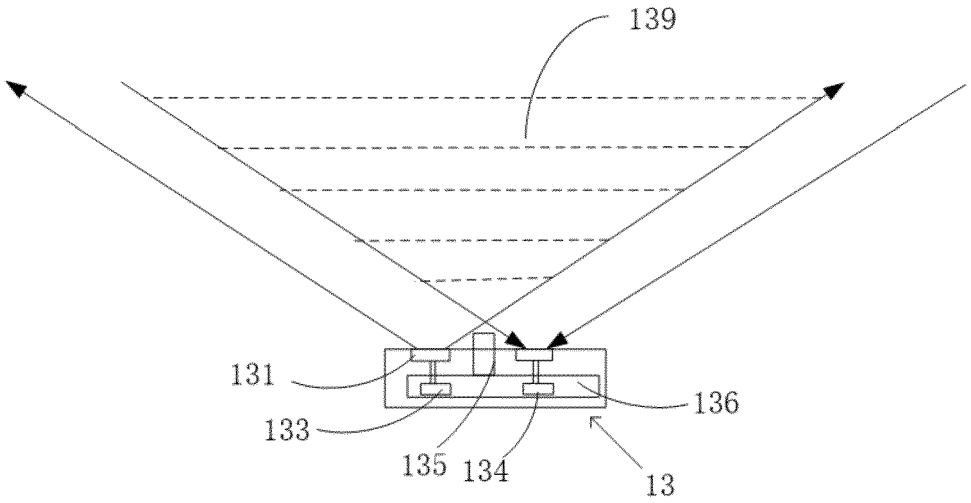

FIG. 5

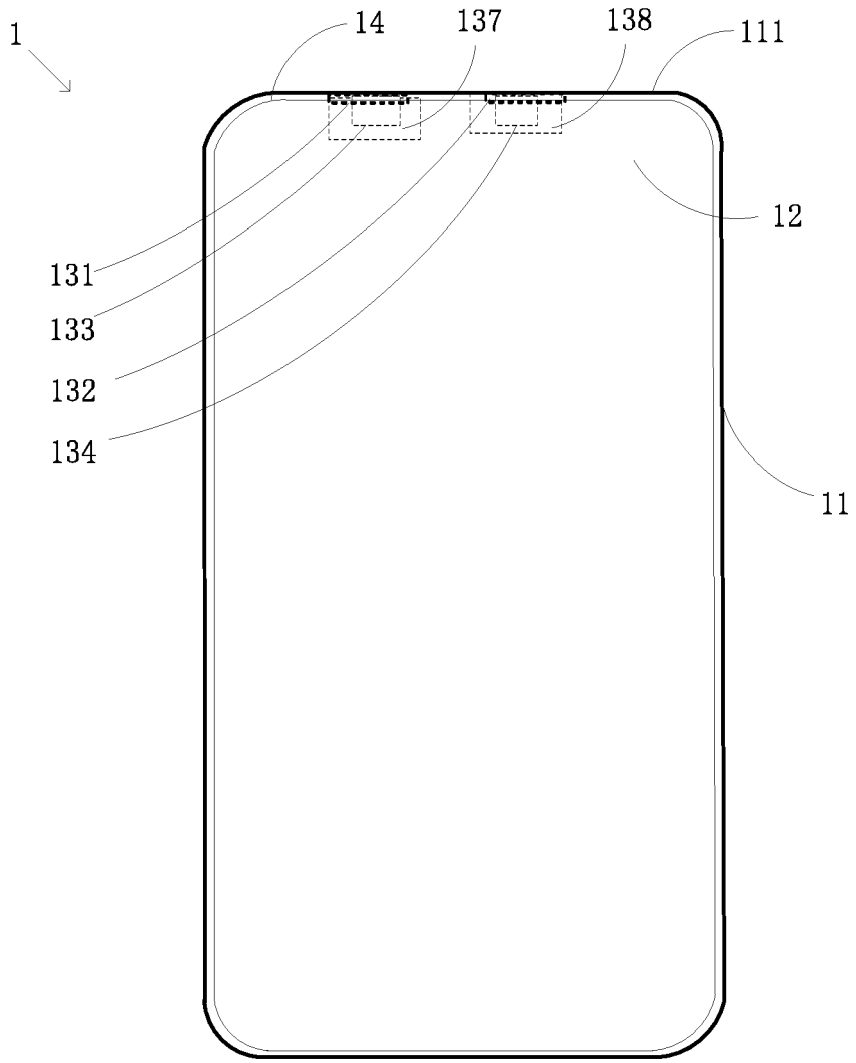

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 20 17 0331

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Place of search	Date of completion of the search	Examiner
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